Long Term Evolution: Short Term Revolution?

LTE is widely expected to be the predominant technology platform for mobile small cells, fixed rural deployments, the industrial internet of things, private networks and probably for other uses not yet envisioned.

By Stephen Coran

According to the Cisco Visual Networking Index released in February 2017, global mobile data traffic is forecast to increase sevenfold from 2016 and 2021. Over that same time, smartphones and machine-to-machine uses are each projected to have traffic growth rates of 49 percent. By 2021, the average mobile-connected end-user device will generate 5.7 GB of mobile traffic per month, up from 977 MB per month in 2016. Globally, there will be 3.5 networked devices per capita.

In the United States, a recent report issued by the FCC found that approximately 39 percent of the population in rural areas — more than 23 million Americans — lacks access to fixed broadband speeds of 25 Mbps down/3 Mbps up. In a separate report, the FCC's data showed that only 42 percent of developed census blocks in the United States have access to more than one broadband provider offering 25/3 Mbps speeds.

Rural Fixed Broadband

These projections and data sets would appear to have little in common. What does the projected exponential growth of global mobile traffic have to do with the need to accelerate the lagging availability of fixed broadband in rural America? As it turns out, quite a bit.

The simple answer is LTE, short for Long Term Evolution, a global standard developed by the 3rd Generation Partnership Project standards body. Although backed by the mobile industry, LTE can be used for fixed broadband service. LTE will carry mobile traffic to meet exploding global consumer demand and will drive deployment of fixed wireless broadband service to underserved rural communities in the United States.

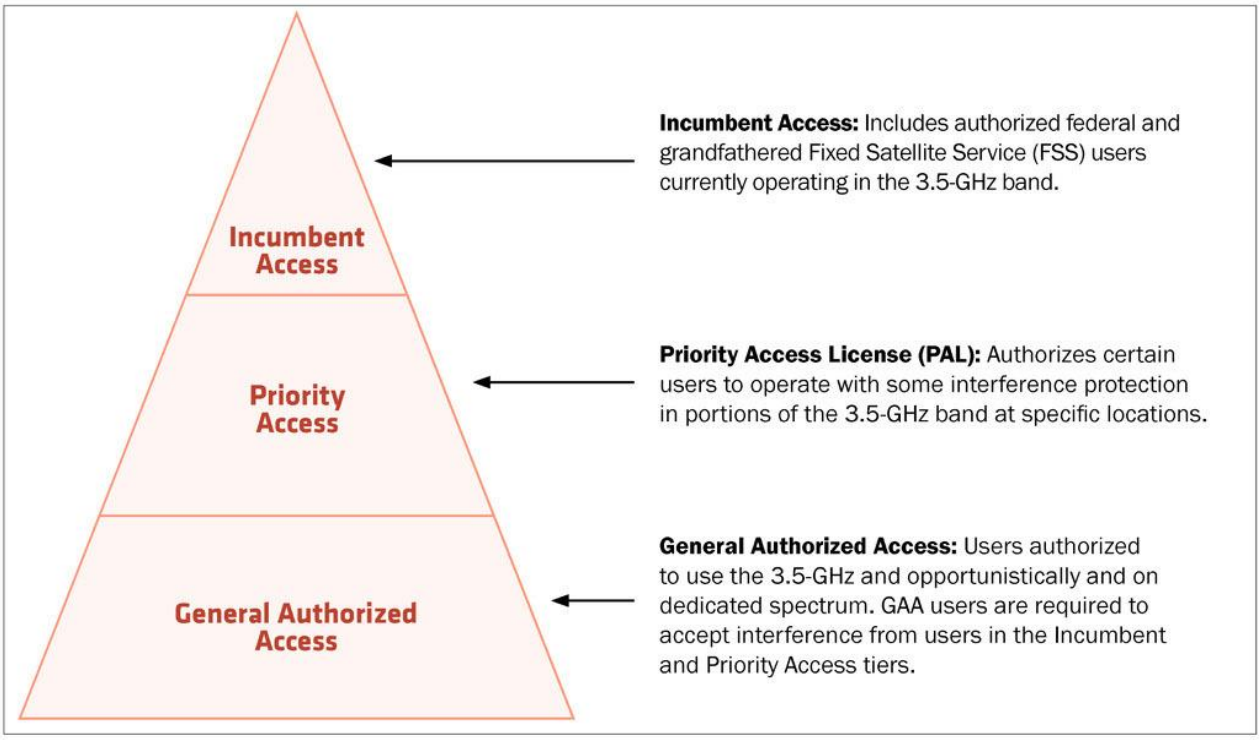
LAA and MulteFire

At least two flavors of LTE will be deployed. Licensed Assisted Access (LAA) uses a licensed control channel in combination with unlicensed spectrum in the 5-GHz band to add capacity for mobile communications to the customer. Ericsson is incorporating LAA in its small cell equipment, and it is widely expected to be deployed in other bands, including the spectrum recently allocated by the FCC to the Citizens Broadband Service (CBRS) under new Part 96 of its rules. The other flavor of LTE, MulteFire, operates on a standalone basis in unlicensed bands. This technology enables a network separate from an existing operator's network or for private networks.

Domestically, and as a subset of the global market, the mobile industry is looking to deploy small cells in the band for offloading voice traffic and connected devices in areas with high population density. By contrast, rural fixed wireless broadband providers are looking for interference-protected spectrum on which to deploy higher-power sites where there is less vertical infrastructure. Other anticipated use cases include private networks for venue owners, such as neutral-host-mediated access to mobile providers, sensors, security networks and other industrial internet-of-things (IIoT) networks at airports, hospitals, shopping malls and other similar places. Indeed, some are referring to the frequency band from 3550 MHz to 3700 MHz as the first 5G band. MulteFire technology can be the go-to platform for private networks for companies, municipalities, office parks, distribution centers and other venues that don't rely on a carrier's platform.

Bandwidth Allocation

But, as with any service that relies on wireless transmission, without a sufficient amount of spectrum and rules designed to make use of LTE, mobile carriers may find it difficult to keep up with demand, and consumers in rural U.S. markets will wait longer for broadband in their homes, farms and businesses. Accordingly, realizing the projected benefits will necessarily hinge on the allocation of sufficient bandwidth.



The three tiers of the Spectrum Access System. *Source: FCC*

Fortunately, here in the United States, the FCC has developed a novel solution — allocating 100 megahertz of spectrum from 3550 MHz to 3650 MHz for mobile and fixed CBRS services. Under rules adopted in 2015 and modified in 2016, this band, previously set aside for exclusive use by earth stations and military radar, will now be shared with commercial interests under the control of a three-tier, dynamic Spectrum Access System (SAS) (refer to the figure on this page).

Here's how it works. Incumbent Access users are always entitled to interference protection. Incumbent Access users include satellite earth stations and military radar, both shipborne and ground-based. The next level is called the Priority Access tier, with licenses to be auctioned in 10-megahertz channels. Users with Priority Access Licenses (PALs) must protect Incumbent Access users, but users with PALs enjoy interference protection over the third tier, referred to as General Authorized Access (GAA).

PAL Auction

Under current rules, PALs will be auctioned according to census tracts. There are more than 74,000 census tracts, with seven 10-megahertz licenses available in each. That's more than 500,000 licenses. GAA is "license by rule," not unlicensed, because users must first be authorized by the SAS to ensure that their operations will not cause harmful interference to either Incumbent Access users or Priority Access licensees. Of the 150 megahertz available, up to 70 megahertz will be set aside for PALs, with the remainder — including all 50 megahertz between 3650 and 3700 MHz — reserved for GAA use. In addition, the FCC adopted a novel "use it or share it" component that allows opportunistic GAA use on PAL spectrum when and where the PAL is not being used.

Those are the basics, but there are also a few add-ons that make this paradigm more flexible and complicated. First, the FCC will, in 2020, combine the existing frequency band from 3650 MHz to 3700 MHz into CBRS, so there will ultimately be 150 megahertz of contiguous spectrum. Since 2008, when the 3650-MHz-to-3700-MHz band